

NASA OFFICE OF DEFENSE AFFAIRS THE FIRST FIVE YEARS

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VIII. MANNED SPACE FLIGHT

The Gemini Program

The Gemini Program was an integral part of the step-by-step progression (i.e., Mercury - Gemini - Apollo) in the development of a capability to conduct manned space flight operations which would lead to the achievement of the national goal of a manned lunar landing. But even before Gemini was initiated early in 1962, it was visualized as a program in which the Air Force would be deeply involved.

The crisis regarding the management of the Gemini Program which occurred at the time the new Office of Defense Affairs was being established has been described earlier in this narrative. As stated, Mr. McNamara's informal proposal that the management of Gemini be transferred to the DOD, and his subsequent formal proposal that the program be placed under joint NASA-DOD management, was met by a compromise NASA-DOD agreement, drafted by Defense Affairs and signed on January 21, 1963, which provided:

- . That the scientific and operational experiments undertaken in GEMINI would be directed at the objectives and requirements of both the DOD and NASA.
- . That a joint Gemini Program Planning Board (GPPB) was thereby established, reporting jointly to the Administrator, NASA, and the Secretary of Defense, and subject to the policy directives of both. The Board would be co-chaired by the Associate Administrator, NASA, and the Assistant Secretary of the Air Force for R&D. It would be the Board's responsibility to assure that the Gemini Program would be planned, executed, and utilized so as to avoid duplication of effort in manned space flight and to insure maximum attainment of both DOD and NASA objectives. The Board would delineate the requirements of both Agencies and monitor the program to insure that the requirements were met in the planning of experiments, in the actual conduct of flight and in-flight tests, and in analysis and dissemination of results.
- . That NASA would continue to manage GEMINI, but the DOD would participate in the development, pilot-training, preflight check-out, launch operations and flight operations to assist NASA and to meet DOD objectives.

- . That DOD would contribute to GEMINI funding.
- . That NASA and the DOD would initiate major new programs or projects in the field of manned space flight in near-earth orbit only by mutual agreement.

The last provision, included at the insistence of Mr. McNamara, represented a major concession by NASA, many of whose key officials regarded it as a one-way restriction. NASA would feel compelled to agree to any manned space flight project determined by DOD to be necessary for national defense. On the other hand, DOD might oppose a proposed NASA project designed to achieve scientific and/or technological objectives on the basis of an opinion that the expected results did not justify the cost, thereby exercising a veto over NASA future planning in this area. However, no difficulty resulted from this provision during the period of this narrative.

The original composition of the GPPB, approved by the Administrator and the Secretary of Defense, was:

NASA:

Dr. Robert C. Seamans, Jr., Co-chairman
 Mr. D. Brainerd Holmes, Director, Office of Manned Space Flight, member
 Adm. W. F. Boone, USN (Ret.) member
 Mr. Richard J. Green, NASA Secretary.

DOD:

Dr. Brockway McMillan, Under Secretary of the Air Force, Co-chairman
 Gen. Bernard A. Schriever, USAF, Commander, Air Force Systems Command, member
 Dr. Lawrence L. Kavanau, Special Assistant (Space), Office of Defense Research and Engineering, member
 Maj. William D. Baxter, USAF, DOD Secretary.

Holmes was replaced by Dr. George E. Mueller in September 1963, Kavanau by Dr. Albert C. Hall in August 1963, and Baxter by Lt. Col. John J. Anderson, USAF, in July 1963.

In all, fourteen meetings were held, the final meeting on April 12, 1965. Thereafter, the functions of the Board were, generally speaking, absorbed by the newly created joint Manned Space Flight Policy Committee, (MSFPC).

The first meeting of the GPPB, held on February 8, 1963, was organizational. The Co-chairmen agreed that one of the functions of the Board was to relate the Gemini project to national objectives in manned space flight as a basis for decisions on any new work to be initiated. Steps were taken to acquaint the Board with the technical and managerial aspects of

the Gemini program and with the DOD objectives in participating in the program. It was agreed that NASA would continue to handle news releases, clearing strictly military matters with the DOD Co-chairman prior to release, and that the DOD would establish the security classification of DOD sponsored experiments on an individual basis, as required. It was proposed by the DOD members that the Dyna-Soar program be brought under the purview of the Board; it was later decided that this would not be appropriate. In general, a cordial and effective working relationship was established at the outset, which prevailed during the entire life of the Board.

The efforts of the GPPB were primarily devoted to:

- . Overseeing the planning and conduct of experiments, including the establishment of priorities, and the processing and dissemination of results;
- . The establishment of criteria and the monitoring of programs for the man-rating of the Titan II launch vehicle, usually referred to in its man-rated configuration as the Gemini Launch Vehicle (GLV).

The Board was kept informed of the status of the Paraglider Development Program, but this program was essentially a unilateral NASA effort and one with which the Board did not concern itself to any great extent.

One of the early actions of the Board (March 7, 1963) was to convene a joint Ad Hoc Study Group at MSC to compare NASA and DOD objectives for the Gemini Program and in the light of this review to recommend a list of DOD experiments for inclusion in the Gemini Flight Program. In addition, the Ad Hoc Group was to recommend to the GPPB the extent and method of DOD participation in GEMINI in accordance with the provisions of the NASA-DOD agreement of January 21, 1963. The final report of this Group was submitted on May 6, 1963.

In jointly agreed guidelines furnished to the Ad Hoc Group, it was specified that the Gemini Program would be conducted so as to satisfy: first, the essential objectives of the Manned Lunar Landing Program (MLLP); and, secondly, NASA and DOD objectives other than those of the MLLP. In the second category, DOD experiments would be given priority. The difficulty of meeting the security requirements of military experiments in an open program was recognized in the guidelines, and the Study Group was asked to develop a policy and methods for coping with this problem.

On April 13, 1963, the initial guidelines to the Study Group were expanded to require that the Group consider an add-on program of two to six Gemini flights, in addition to the twelve originally planned, these flights to be sponsored and funded by the DOD and specifically oriented toward the development of equipment for DOD mission objectives and the training of DOD astronauts. The military missions in which the DOD was interested had previously been identified by Mr. McNamara.

In response to an interim report of the Study Group, an Air Force Field Office, as an extension of the Space Systems Division (SSD) of AFSC, was established at MSC on August 25, 1963. Its function was generally to assist in the planning and implementation of DOD participation in and support of Gemini and specifically to manage the integration of DOD in-flight experiments into the Program. This office, headed by Col. Dan McKee, was composed of about eleven Air Force Officers stationed at MSC and two at what was then NASA's Launch Operations Center, Cape Canaveral.

Much of the time and effort of the GPPB was devoted to the program of man-rating the TITAN II. The early engineering test flights of this vehicle revealed problems of longitudinal oscillation during first-stage flight and of second-stage combustion instability. The Air Force initiated intensive programs to correct these deficiencies and to improve overall vehicle reliability. The Board monitored these programs very closely. NASA made its in-house competence available to assist.

NASA undertook a simulation program utilizing the centrifuge at Ames to study the effect of the longitudinal oscillations on astronauts. It was found that the "POGO effect" encountered in the early test flights was sufficient to blur the vision of an astronaut to the point that he could not read the panel instruments. A maximum acceptable amplitude of vibration was established in these tests, and the Air Force was able to devise fixes which brought the GLV performance within this tolerance.

The combustion instability was also corrected in good time, so that the GLV ultimately proved to be a highly satisfactory and dependable vehicle.

The list of DOD experiments recommended by the Ad Hoc Study Group was approved in principle by the GPPB. Primarily, these experiments were directed toward determining the military usefulness of a man in space and the physiological effects on man of protracted exposure to weightlessness.

The flying of classified experiments was a controversial issue, not as much between NASA and the DOD as within NASA itself. Some key NASA officials vigorously opposed the imposition of any security restrictions on the character of Gemini experiments or their results, contending that to do so would compromise the open nature of NASA's program and the peaceful image of the Agency. Defense Affairs took a strong position in favor of flying DOD experiments and of imposing the minimum security measures considered necessary by the Defense Department in the national interest. We cited the clear intent of the Space Act that the civilian and military segments of the total activity of the United States in space should be mutually supporting and the authority given the Administrator to "establish such security requirements, restrictions, and safeguards as he deems necessary in the interest of national security." The Defense Affairs position was eventually supported by NASA top management. A plan was worked out under the aegis of the GPPB whereby DOD classified experiments were installed prior to flight and removed after recovery without exposure to the public, and results were

screened by a joint committee who decided what should and should not be released. The arrangements worked out very satisfactorily.

In response to a request from Mr. McNamara that the Board examine its role in the planning for the use of elements of the Gemini Program in other DOD and NASA projects, the Co-chairmen agreed to monitor DOD-NASA studies in the Manned Orbiting Laboratory field and to select certain of these studies for detailed review by the Board.

Some forty-nine experiments were scheduled for the Gemini flight series, of which sixteen were DOD experiments. Some of these experiments were conducted more than once.

The Board recommended that additional Gemini flights under Air Force management specifically to meet DOD objectives not be scheduled except as part of a well defined and continuing military program. Later, one Gemini-B engineering test flight was flown as part of the DOD's MOL Program.

Coordination of Studies of Manned Orbiting Space Stations

A long series of discussions, exchanges of correspondence, and agreements on this subject had its origin in the AACB meeting of March 19, 1963. Mr. D. Brainerd Holmes, Deputy Associate Administrator for Manned Space Flight, NASA, and Chairman of the MSF Panel, outlined NASA's plans for studies related to space stations. Dr. Brockway McMillan, Assistant Secretary of the Air Force (R&D) and Vice Chairman of the MSF Panel, said Mr. McNamara believed that neither Agency should perform studies in this area without the other's concurrence. The Co-chairmen requested that the MSF Panel develop recommendations for insuring the desired NASA-DOD coordination of manned orbital space station studies.

On April 24, 1963, Dr. Seamans wrote to Mr. John Ruble, Assistant Secretary of Defense (DDR&E), expressing his views in the premises. He stated that the existing agreement not to undertake a major launch vehicle or spacecraft development for manned flight beyond Apollo without joint NASA-DOD approval did not encompass advanced studies designed to provide essential data for wise decisions on such developments. He said NASA was unwilling to accept the delay and complicated technical monitorship which would accompany a joint-concurrence approach.

Mr. Webb wrote to Mr. McNamara that same day, drawing attention to the apparent lack of a meeting of the minds concerning the proper coordination of exploratory studies. Referring to the essentiality of advanced studies in meeting NASA's statutory responsibility to achieve and maintain a position of world leadership in science and technology, Webb stated his position in terms similar to those contained in Seamans' letter to Ruble. He took a conciliatory tone, saying he would like nothing better than a two-way exchange of ideas and plans concerning the initiation of such advanced studies and offered to meet with the Secretary to discuss the matter personally.

A letter from McNamara to Webb of May 25, 1963, referred to their "recent discussions," and enclosed a proposed DOD-NASA agreement "Concerning a Manned Orbital Test Station Program" which Mr. McNamara had signed. (This method of transacting business, in which the Secretary would forward a signed draft agreement to the Administrator for the latter's signature without the benefit of any prior mutual starting, was a gambit used more than once by Mr. McNamara.)

The proposed agreement called for the establishment of a joint "Manned Orbital Test Station Program Planning Group" under the Co-chairmen of the AACB to monitor and, when necessary, to sponsor studies in this area. The proposed agreement provided that, should either Agency decide to formulate a program based on the results of such studies, the development plan would be given to the Group for examination as to conformity with both NASA and DOD requirements. The plan would be forwarded through the Co-chairmen,

AACB, to the Secretary and the Administrator for their joint approval. In the event the program was to be undertaken, a "national decision" would be made as to assignment of management responsibility.

Mr. Webb did not sign the proposed agreement. Instead he proposed in a reply to Mr. McNamara dated June 7, 1963, that they await the outcome of related staff work then in progress in the AACB before deciding what further definitive action would be in order.

At the AACB meeting on June 27, 1963, Holmes presented a proposal, signed by McMillan and himself, setting forth a recommended procedure for ensuring NASA-DOD coordination in the area of studies of manned orbiting space stations. The AACB Co-chairmen took the proposal under study, expressing a desire to consummate a NASA-DOD agreement on this subject prior to the next meeting.

At the next meeting on August 9, 1963, Dr. Brown stated that the Holmes-McMillan agreement provided only a mechanism for an exchange of information, that DOD desired a more formal procedure including a requirement for joint concurrence on the initiation of all such studies, and that Mr. McNamara would send a proposed agreement to Mr. Webb. Dr. Seamans expressed reservations concerning the proposed sign-off requirement. The Co-chairmen again agreed to attempt to resolve the matter prior to the next meeting.

The DOD position caused considerable concern in NASA Headquarters. It seemed evident that Mr. McNamara was seeking to exercise control over NASA study efforts in this area. Mr. Webb desired to avoid a confrontation with Mr. McNamara on this issue, but was determined not to accept voluntarily a veto power by the Secretary of the Defense over the NASA study effort considered essential by the Administrator as a basis for NASA programmatic and planning decisions.

Mr. McNamara's second letter to Mr. Webb on this subject, dated August 8, 1963, enclosed a joint memorandum from the Co-chairmen of the AACB to the Chairman of the MSF Panel, already signed by Dr. Brown, which concurred in the procedure proposed by the Panel for the coordination of studies of a manned orbital laboratory, characterizing the procedure as a "mechanism for exchange of information between the Department of Defense and the National Aeronautics and Space Administration on manned orbital stations." Mr. McNamara said that if Dr. Seamans agreed, he should sign the memorandum. Dr. Seamans did not agree and did not sign the memorandum.

Mr. McNamara went on to say that he was not satisfied that a mere exchange of information was sufficient in this important national effort. He felt that he and Mr. Webb should agree to more formal coordination in this field. Accordingly, he enclosed a proposed DOD-NASA agreement, again one which we had not seen before but which Mr. McNamara had signed. He requested that Mr. Webb sign if he were in agreement with the approach to the problem reflected in the proposed agreement.

This latest proposed agreement contained a preamble which stressed the essentiality of centralized coordinated planning of DOD and NASA needs and requirements in any follow-on program after Apollo. The substance of the proposed agreement was a provision which would have required a joint sign-off as a condition for the initiation of any contractor study program or project in the field of manned orbital test stations of a magnitude equal to or greater than a \$1,000 per year level of effort. The proposal further provided that concurrence authority would be delegated to the Co-chairmen of the AACB and that concurrence would be automatic if a written reply to a request for concurrence were not received within fourteen days.

Mr. Webb declined to sign this document also. While it did to a degree meet Webb's concern over the previously proposed categorical sign-off requirement of all manned space flight studies, the proposed terms were inadequate and represented an oversimplification in that they did not define an orderly and effective cooperation and coordination process.

In consultation with our opposite staff people in DDR&E, Defense Affairs prepared a new draft agreement for consideration in lieu of the proposed Brown-Seamans memorandum to the MSF Panel and the NASA-DOD agreement proposed by McNamara. Our draft reflected Mr. Webb's sharing of Mr. McNamara's opinion that the Holmes-McMillan proposed procedure did not go far enough in establishing a basis for effective NASA-DOD contribution and the view of all of us in NASA that the submission of any study work statement for concurrence and/or comments by the other Agency should be preceded by adequate mutual staff work to ensure that the needs of both Agencies were met and that there was no unwarranted duplication.

In a preamble of "Basic Considerations" the draft stated: "The National Space Program has now advanced to the point that further significant programs in the areas of scientific research, space exploration, basic space technology, and defense applications may well require the operation of a manned orbit research and development system involving spacecraft larger and more sophisticated than Gemini and Apollo." It further expressed the common view of the Secretary and the Administrator that, so far as practicable, the future requirements of both Agencies in this area should be encompassed in a single project.

The proposed agreement provided that, should the Secretary and the Administrator not agree on any issue considered by either party adversely to involve the responsibilities of his Agency, the issue would be jointly referred to the President through the Space Council for resolution. It further provided that the DOD and NASA would continue to conduct advanced and exploratory studies in this area as considered necessary by the Secretary and the Administrator, respectively, and that these studies would be coordinated under the AACB in accordance with a detailed procedure set forth in an attachment.

The draft contained the following additional provisions:

- a. The DOD and the NASA will continue advanced and exploratory studies in this area as considered necessary by the Secretary of Defense and the Administrator, NASA, respectively, to develop data as to Agency requirements, possible design concepts feasibility, and costs; these studies will be coordinated under the AACB in accordance with the procedures set forth in the attachment hereto.
- b. The AACB will conclude the evaluation of various concepts from the standpoint of productiveness, feasibility, and estimated costs.
- c. The Secretary of Defense and the Administrator, NASA, will then attempt to arrive at a joint recommendation as to whether to proceed with a new project in this area, evaluating the national need by comparing potential returns to returns which could be realized by an extension of current on-going projects.
- d. If the recommendation under c, above, is affirmative, the DOD and the NASA will jointly formulate an agreed project description for submission to the President via the National Aeronautics and Space Council together with
- e. A recommendation as to the responsibility for the direction of the project based on predominant interest and consideration of other pertinent factors, such as management competence, relation to other programs in progress, and international political implications.
- f. If and when a decision is made by the Administration to proceed with such a project, the appropriate timing determined, and responsibility for direction assigned, a joint DOD/NASA board will be established to formulate the specific objectives to be obtained by means of the project and to approve the experiments to be conducted.
- g. Acting in accordance with the results of f, above, the Agency assigned responsibility for direction will prepare a definitive project plan for approval by the Administration and submission to Congress for funding.
- h. On provision of the necessary funding, the project will be implemented under single management but with joint DOD-NASA participation and monitorship.

The detailed procedure attached provided for an expeditious review by the MSP Panel of completed and on-going studies to determine which of these required coordinating action. The Panel would thereafter designate to the AACB those future studies which either Agency considered should be formally coordinated. After designation of a study for coordination, the non-sponsoring Agency would be allowed fifteen days for concurrence or, if not concurring, for submitting written reasons for non-concurrence, together with a list of requirements desired to be incorporated. The absence of a reply within the fifteen-day limit would be considered concurrence. Likewise, the AACB would be allowed thirty days after designation to either (1) certify in writing that satisfactory coordination had been accomplished or (2) jointly submit to the Secretary and the Administrator an explanation of any areas of disagreement. At that point, the sponsoring Agency might, if desired, proceed with the study.

Mr. Webb's letter for transmitting the draft agreement (with attachment) to Mr. McNamara set forth Mr. Webb's views on this subject at some length and expressed his desire to "go more than half way" to meet Mr. McNamara's requirements in the premises. Before signing the letter and the draft agreement, Webb tried to call Mr. McNamara on August 17, 1963, to see whether he could personally call on the Secretary to discuss the letter and agreement. The Secretary was not available in the Pentagon, and so Mr. Webb dictated an additional covering letter, telling of his attempt to arrange a personal call to deliver the agreement and letter of transmittal. He then signed all three documents and mailed the package. The covering letter said that the addition of George Mueller and other new senior officials in MSP and the centralization of control of the administration of all such agreements under Admiral Boone "should go a long way toward eliminating some of the problems we have had in achieving a full understanding all up and down the line as to what objectives we were seeking in these projects and in our relations with DOD." Mr. Webb said finally that if the agreement did not meet with what Mr. McNamara had in mind, he (Webb) would like to go over to Mr. McNamara's office and talk the matter over.

We immediately began submitting studies for DOD concurrence or comment, in advance of Mr. McNamara's action on the proposed agreement and coordination procedure. On August 23, 1963, I sent to Dr. Hall (DDR&E) a long list of potential NASA engineering and scientific experiments for the MOL.

Mr. McNamara's reply to Mr. Webb's letter of August 17 was sent on September 16, 1963. The Secretary said that he appreciated Mr. Webb's constructive and earnest efforts to develop a method which would insure a sound, coordinated approach to this potentially important national effort, that many activities had already been implemented which had gone a long way toward improving the exchange of information and coordination in our study efforts, that he concurred in our proposed agreement in many respects and felt it was an excellent contribution to improved understanding and mutually useful effort, but did so with certain reservations.

The Secretary's reservations related to possible unilateral action in the face of disagreements and to NASA's proposed \$3.5-million contractor study effort for the design of a Manned Orbital Research Laboratory, which study he considered to be premature by eight months to a year, as the DOD would need that much time to make judgments on incorporating DOD requirements into the design. He was concerned that the agreement did not define a level of effort to qualify a study for coordination and still thought \$100,000 would be a reasonable threshold. He agreed that the AACB, if properly constituted and used, was the proper medium for interagency coordination. He felt that the President should be informed concerning the nature and extent of any disagreement before any program actions were initiated unilaterally. He believed that it was not essential at that time to define the procedure for implementing a possible development program.

Finally, Mr. McNamara said that, hoping Mr. Webb could accept his expressed reservations, he had signed the agreement (September 14, 1963) as NASA had prepared it.

Mr. Webb's reply on September 23, 1963, contained renewed assurances of our continued effort toward further improving the NASA-DOD effectiveness in the manned space flight area. In noting Mr. McNamara's expressed reservations and concern, the Administrator reaffirmed his desire to do all he could to insure that any advanced engineering studies would be so integrated that the requirements and design constraints of both Agencies would be taken fully into account from the outset. Mr. Webb stated he was submitting the \$3.5-million study, referred to by McNamara, to the AACB for coordination.

In implementation of the Webb-McNamara agreement of September 14, 1963, the AACB assigned to the MSF Panel responsibility for optimizing the utilization of current and planned earth orbital studies and the establishment of requirements which would meet the objectives of both DOD and NASA in this area. On November 6, 1963, the MSF Panel formed a National Space Station Planning Subpanel (NSSPS) to perform this function, the charter of which was approved by the AACB on January 31, 1964. (See Attachment VIII.)

The NSSPS met four times during 1963 and then lapsed into inactivity. With the reconstitution of the MSF Panel in 1967, as described elsewhere herein, the Panel assumed the functions of the Subpanel, and the Subpanel was disestablished, effective December 31, 1967.

Agreement Covering a Possible New Manned Earth Orbital Research and Development Project

Toward the middle of 1963, Mr. McNamara and his principal subordinates for R&D apparently felt the need for a further agreement covering a possible major space station development, an agreement more comprehensive and detailed than the clause in the Gemini agreement of January 21, 1963, which restrained either Agency from initiating a major new program of manned space flight in near-earth orbit without the concurrence of the other. DOD wished to place special emphasis on coordination in the early conceptual states of advanced exploratory studies in this area. Several such studies had been conducted or were in progress in both Agencies.

The result was a NASA-DOD agreement, signed into effect on September 14, 1963, after lengthy negotiations, which was titled "Agreement Between the Department of Defense and the National Aeronautics and Space Administration Covering a Possible New Manned Earth Orbital Research and Development Project."

The preamble to the agreement stated that its purpose was to insure that in the national interest complete coordination would be achieved between NASA and the DOD in approaching a possible new project in the area of manned earth orbital research and development vehicles. It was recognized that the National Space Program had advanced to the point that further significant progress in the areas of scientific research, space exploration, basic space technology, and defense applications might well require the operation of a manned orbital system larger and more sophisticated than GEMINI and APOLLO. Since such a system would be a major technical and financial undertaking, advanced exploratory studies and any follow-on actions should be most carefully coordinated in the AACB. So far as practicable, all foreseeable future requirements of both Agencies, and any other interested government agencies, should be encompassed in a single project, and it appeared that this could be done.

It was further recognized that such an advanced R&D system capable of prolonged space flight would provide basic scientific and technical knowledge and basic design and operational criteria applicable across the board to both military and civilian operational programs and would be a mandatory forerunner of any long-duration manned space operational system.

Salient points of the basic agreement were:

- . NASA and the DOD agreed to a common approach to such a project.
- . Each Agency would continue advanced, exploratory studies in this area to develop data as to agency requirements, design concepts, feasibility and costs;

studies would be coordinated under the AACB in accordance with agreed procedures set forth in an attachment to the basic agreement.

- . The AACB would evaluate concepts from the standpoint of productiveness, feasibility, and estimated costs.
- . NASA and the DOD would attempt to arrive at a joint recommendation as to whether to proceed with a new project in this area, evaluating the national need by comparing potential returns to returns which could be realized by an extension of current on-going projects. If the recommendation were affirmative, a jointly formulated project description would be submitted to the President.
- . A recommendation as to management responsibility would be made, based on predominant interest and other factors such as management competence, relation to other programs in progress, and international political implications.
- . If and when a decision was made to proceed, a joint NASA-DOD board would be established to formulate specific objectives and approve experiments.
- . On provisions of the necessary funding, the project would be implemented under single management but with joint participation and monitoring.

A detailed procedure for joint reviews by the MSF Panel of the AACB of all studies in this area completed in the previous three years or then in progress, and for a coordinated approach to all future studies, was contained in the attachment to the basic agreement. Consultation would begin early in the conceptual or planning stage of a new study effort, a measure strongly stressed by Defense Affairs as a prerequisite to effective coordination. (A description of proper "coordination,"* which I had written

* My definition of "coordination":

"An activity having responsibility to "coordinate" with another activity in discharging an assigned function will: (1) recognize the interest of the other activity; (2) initiate a full and timely exchange of information and consultations; (3) encourage the active participation of the other activity from the outset; and (4) make an earnest effort to meet the requirements and objectives of the other activity.

"Concurrence of the other activity will be sought in the proposed action. Concurrence is not required as a precondition to taking action; however, matters on which agreement is not reached may be referred for resolution to the next higher authority in which both activities have a voice."

years earlier and which had been accepted by the Military Services, was furnished to our Program Offices.) The Panel would identify to the AACB those studies being processed or considered which, in the opinion of either Agency, required formal coordination to incorporate the requirements of both Agencies and avoid unwarranted duplication of study effort. Time limits were prescribed for the submission of comments by an Agency on a proposed study by the other. An explanation of any areas of disagreement would be furnished by the AACB to the Secretary of Defense and the Administrator, after which the sponsoring Agency would be free to proceed with the study, if desired. These latter provisions were incorporated into the agreement at our insistence to prevent the indefinite delay of a study because of lack of agreement as to its nature or justification.

Pursuant to this agreement of September 14, 1963, the MSF Panel announced at the meeting of the AACB on November 7, 1963, that a subpanel was being established to coordinate NASA and DOD manned space station studies, and that the provisions of the agreement were being met (see charter, Attachment VIII). While a certain amount of foot-dragging on the part of some individuals in OMSF had to be overcome in bringing the DOD representatives into our study plans sufficiently early to fully meet the intent of the agreement, the procedure proved to be reasonably effective. The subpanel is still functioning.

The Air Force Manned Orbiting Laboratory (MOL) Program

On December 10, 1963, Mr. McNamara announced cancellation of the Dyna-Soar Program and assignment to the Air Force of a new program for the development of a near-earth Manned Orbiting Laboratory (MOL).

The primary objective of the MOL Program, as announced by the Secretary of Defense, was to determine the military usefulness of man in space. Secondly, the MOL was to carry various military experiments involving manned use of equipment and instrumentation in orbit. NASA was invited to propose technological and scientific experiments for civilian use which would be incorporated on a payload-capacity-available basis.

This announcement was followed by a protracted phase of program definition in which NASA coordinated with the DOD in evolving a system concept for meeting the military requirements established unilaterally by the DOD. This concept differed somewhat from the original DOD concept. When the Air Force was finally authorized to proceed with the MOL project, Defense Affairs prepared a letter for Dr. Seamans to send to Dr. Brown, then still the Director of Defense Research and Engineering but the newly-designated Secretary of the Air Force, which pledged NASA's full support of the Program. The letter, dated September 27, 1965, expressed NASA's concurrence in the justification of an experimental manned space flight program under the Military and our accord in the stated MOL objectives. The DOD invitation to NASA to participate in the MOL flight missions was accepted. While we foresaw certain problems in integrating purely civilian experiments into the classified MOL program, we felt that these could be surmounted. Finally, the letter stated that NASA stood ready to plan with the Air Force for the maximum practical utilization by the DOD of NASA-developed hardware and technology; our production, testing, check-out, simulation, training, mission control, and data acquisition and processing facilities; and our management and operational experience.

We foresaw that the interrelationships between the MOL and the Gemini, Apollo, and Apollo Applications programs, as well as the NASA support of and participation in the MOL Program, would require joint planning and monitoring on the policy decision level. Dr. Seamans' offer to meet with Dr. Brown to discuss methods to accomplish this led to establishment of the Manned Space Flight Policy Committee, (MSFPC) which will be discussed later.

Defense Affairs drafted an internal NASA position paper with respect to the MOL project which, in addition to matters covered in the letter of September 27, included the following points as reflecting NASA's attitude toward the project:

- . The MOL is a single military project (a specific goal; not a broad program) within the total national space program.

- . It should not be construed as the national space station, which is a separate program currently under joint study by NASA and the DOD.
- . Were it such a space station program, it would have to be jointly considered and dealt with under the terms of the Webb-McNamara agreement of September 14, 1963, regarding future manned orbital research and development systems larger than GEMINI and APOLLO. The objectives of the MOL are not within the scope of NASA's activities.
- . Since the MOL project is not a national space station, the procedure calling for a joint recommendation to the President, as prescribed in the Webb-McNamara agreement of September 14, 1963, is not considered applicable.
- . The MOL project does not conflict with NASA manned and unmanned flight projects and does not affect the high priority of the Nation's goal of landing a man on the moon before the end of the decade.

The design concept of MOL was premised on the use of a somewhat modified Gemini spacecraft (designated Gemini B) as the crew compartment during launch and recovery and the use of Gemini and Apollo subsystems to the maximum extent technically feasible. It was to be launched on a Titan III booster. NASA pledged full support of the Program. All Gemini Program equipment for which MOL had a requirement was transferred to the DOD, on a nonreimbursable basis, as soon as it was no longer needed by Gemini. This transfer included three Gemini spacecraft which had been flown, a thermal test spacecraft, numerous Gemini engineering models, boilerplate and static test spacecraft, most of the aerospace ground equipment, factory test equipment, tooling, about forty-three recovery training spacecraft models and all associated recovering equipment, a Gemini mission simulator and many similar components, various articles of subsystem hardware, etc. The material transferred represented an original cost to NASA of about \$100 million.

Training aids were made available for DOD use on a shared basis. It was determined that it was not practicable to have a single joint program for the training of astronauts. Apollo ships and tracking stations were made available to support MOL on a basis of noninterference with APOLLO. A NASA engineer, Mr. Michael I. Yarnmovich, who was thoroughly familiar with the Gemini design, was detailed to Air Force Headquarters for work on MOL, and an engineer from the Manned Spacecraft Center, Mr. Duncan Collins, was detailed to the Space Systems Division of AFSC. NASA Reliability and Quality Control personnel working on GEMINI were detailed to the Air Force to work on GEMINI B and MOL. NASA managers, engineers, and technicians were made available to consult with their Air Force counterparts as needed.

Modifications to Gemini spacecraft for use in Gemini B engineering flights were accomplished through an extension of the NASA contract for the procurement of Gemini's. An agreement was consummated under which the Air Force could contract directly with McDonnell Aircraft for the production of Gemini B's on a basis of no delay in the production of Gemini's.

Arrangements were made for NASA officials to have access to MOL data as necessary to avoid unnecessary duplication of effort, provide technical advice and support, and eliminate program procurement and operational conflicts.

Several joint cooperation mechanisms were established in the field of space medicine/bioastronautics, notably one involving space suit development.

A number of studies were made to explore technical feasibility and economic factors in the use of the MOL laboratory module in the Apollo Applications Program (AAP), the use of Titan III to launch AAP missions, and the adaption of Apollo/Saturn hardware to the MOL mission.

NASA support to MOL in the form of technical advice and assistance, transfer of hardware, contract negotiations, and analytical studies came directly out of OMSF. Tracking, communications, and data handling support arrangements were made in OTDA. Other Program Offices and some of the Headquarters functional offices also performed support roles. Defense Affairs was very active in planning, initiating, coordinating, and monitoring all aspects of the support effort, in drafting or reviewing support agreements, in arranging transfers of exchange personnel, in scheduling briefings, in formulating directives or charters for ad hoc coordinating groups, in arranging security clearances, etc.

The Manned Space Flight Policy Committee (MSFPC)

The preliminary actions leading to establishment of the MSFPC on January 14, 1966, were an example of a procedure long advocated by Defense Affairs as a means of smoothing out the interactions between NASA and the DOD and of avoiding head-on confrontations on controversial issues. We advocated a standard procedure of attempting to reach a meeting of minds on any important proposed action by means of informal interagency discussions before the internal views of one Agency became crystallized into an official Agency position through presentation in formal correspondence. Soliciting the comments of the addressee or other party regarding a proposed letter or agreement while still in draft form and if necessary face-to-face discussions by staff representatives before finalizing the document were key features of this recommended procedure. NASA top officials were always willing to follow this procedure in dealing with potentially controversial matters, but not so in all cases on the DOD side.

Dr. Seamans' letter to Dr. Foster of September 27, 1965, pledging full NASA support of the MOL Program, was, of course, well received. Dr. Foster agreed in principle that a new coordinating mechanism was needed to conduct joint planning on the policy decision level concerning NASA's support of the MOL and coordination of the manned space flight programs of the two Agencies in general. Because of the security classification of the MOL and the sensitivity of some of the planned military experiments, it was considered advisable that the necessary coordination be accomplished outside the framework of the AACB.

Before Dr. Foster's views were formally sent to NASA in writing, I met with Mr. Daniel J. Fink, Deputy to Dr. Foster for space systems, to discuss a draft reply to Dr. Seamans' letter. Together we worked out arrangements to establish a new joint group which later was given the title of "The Manned Space Flight Policy Committee." We agreed on the composition and functions of the group and were in agreement that the new group should absorb the functions of GPPB, noting that the latter group had not met in some seven months. These informal agreements were incorporated in Dr. Foster's reply to Dr. Seamans dated November 19, 1965.

Dr. Foster felt that a formal charter for the new group would not be essential, but was amenable to having one if Dr. Seamans so desired. We on the NASA side did prefer a charter. Mr. Fink and I met on December 2, 1965, to work one out.

The MSFPC was established by a NASA-DOD Memorandum of Understanding approved by Mr. Webb and Mr. McNamara, effective January 14, 1966. It superseded the agreement of January 21, 1963, which had established the GPPB. The agreement provided that the MSFPC would be composed of the Deputy Administrator of NASA (Dr. Seamans) and the Director of Defense Research and Engineering of the DOD (Dr. Foster), acting as Co-chairmen, and two addi-

tional members from each Agency to be approved by the Administrator and the Secretary of Defense. The functions assigned in the charter were:

- a. To resolve those matters concerning the mutual participation in and support of the manned space flight programs of the two Agencies which could not be resolved at a lower level.
- b. To arrive at agreements involving top policy determinations.
- c. To facilitate the exchange, at top management level, of viewpoints and information of importance in the coordinated planning of the manned space flight programs of NASA and the DOD.

In addition to Dr. Seamans and Dr. Foster, the initial membership was:

NASA

Dr. George E. Mueller, Associate Administrator for Manned Space Flight
Dr. Homer E. Newell, Associate Administrator for Space Science and Applications.

DOD

Mr. Daniel J. Fink, Deputy Director, DDR&E (Strategic and Space Systems)
Dr. Alexander H. Flax, Assistant Secretary of the Air Force (Research and Development).

Pursuant to the concept of a membership empowered to make policy decisions for their respective Agencies and being mindful of security considerations, Dr. Foster had wished to keep the group small and to dispense with the formality of having secretaries to prepare minutes of meetings. He envisaged an informal procedure at meetings, with written documents limited to simple advance agenda and brief memoranda to record agreed action items.

This arrangement imposed some difficulties for NASA. Since the procedural functioning of this committee was to fall within the purview of Defense Affairs, Dr. Seamans' initial thought was that I should be a member, but when it became evident that the NASA experiments most likely to be considered for the MOL would be in the categories of space sciences and earth resources observations, both categories being under Newell, it was considered essential that he be the third NASA member. The internal arrangement was that one of the NASA members would brief me promptly and fully after each meeting so that I could initiate or monitor the necessary follow-up actions and could work with Fink or Flax in keeping records of the meetings. While reasonably satisfactory in theory, this arrangement did not

work out well in practice. It was always difficult for Seamans, Mueller, or Newell, all being very busy people, to find time to fill me in concerning discussions at meetings in sufficient detail to enable me to discharge my responsibilities in a proper manner.

In October 1966, I discussed with Mr. Fink the need for a secretary or co-secretaries for the MSFPC, with the result that Lt. Col. Floyd J. Sweet of my office and Maj. William R. Yost, USAF, from DOD, were appointed as Co-secretaries, effective December 13, 1966. This move considerably facilitated the role of Defense Affairs in support of the MSFPC, but still was not an entirely satisfactory substitute for my hearing the discussions of the Committee first hand. I continued to feel that we should have pressed Dr. Foster to accept a membership of four from each side so that Defense Affairs could be included.

On December 20, 1967, the Administrator approved a revision of the charter of the MSFPC which provided that:

- a. The Co-chairmen would no longer be designated by title;
- b. The other members would be appointed by the Co-chairmen;
- c. Two Executive Coordinators, one from each Agency, would be appointed to provide staff support (replacing the Co-secretaries) and to handle the day-to-day committee business; and
- d. The Co-chairmen would have the authority to establish coordination and/or review sub-groups as needed.

Mr. David Williamson, then in the Office of Program Plans and Analysis, was appointed as the NASA Executive Coordinator.

: At their meeting on September 12, 1966, the MSFPC appointed a sub-group, designated the Survey Applications Coordinating Committee (SACC) to coordinate the technical aspects of various experiments planned for DOD and NASA manned space flight missions, including those associated with NASA's Earth Resources Survey Program (ERSP). The initial NASA membership of this group was:

Mr. Edward Z. Gray, Co-chairman
Mr. Leonard Jaffe
Mr. Frank J. Sullivan
Lt. Col. Floyd J. Sweet, NASA Secretary.

This sub-group met first on September 29, 1966. Meetings were held at the call of the Co-chairmen. There were a total of nine meetings held during the period of this narrative.

The first meeting of the MSFPC was held on January 21, 1966. Between then and the end of 1967, five more meetings were held. The Board functioned effectively in exchanging information and in coordinating a wide range of matters pertaining to the interrelationships between the MOL program of the DOD and the Gemini and Apollo programs and post-Apollo planning of NASA. A number of studies were conducted under the aegis of the Committee, notably one to determine the advantages and disadvantages of using Titan III/MOL hardware in the AAP and of using Apollo/Saturn hardware for the MOL Program. Various mixes of Titan III/MOL and uprated Saturn I/Apollo systems for low earth orbit missions were examined in these studies.

One of the early actions of the Committee was to agree on a revised charter for the Manned Space Flight Experiments Board (MSFEB), an advisory board to the OMSF on which the DOD had representation.

As the principal policy matters generated by the advent of the MOL Program and of mutual concern were dealt with and resolved by the MSFPC, the work of the Committee tended more and more to be accomplished through individual contacts of NASA and DOD cognizant officials. Up until the appointment of the two Executive Coordinators, much of the back-up work for the Committee was done by Defense Affairs with, of course, the help of other Offices. We proposed agenda items and discussed our items and those proposed by DOD with the cognizant NASA and DOD officials. We prepared NASA position papers on agenda items, briefed Dr. Seamans and the other NASA members in preparation for meetings, drafted and negotiated agreements, wrote supporting papers, and generally performed or monitored all of the necessary support work for the Committee.

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<u>Subject</u>	<u>NASA Representatives</u>
Reentry Vehicle Programs to include Project FIRE	Mr. Abraham Hyatt
	Mr. Marvin Schuldenfrei, Office of Plans and Program Evaluation, NASA Hq.
	Dr. A. J. Eggers, Jr., Ames Research Center
Manned Orbiting Laboratory	Mr. Abraham Hyatt
	Mr. Marvin Schuldenfrei
	Dr. William A. Lee, Director, Systems Studies, Office of Manned Space Flight, NASA Hq.
Ability of Man To Increase the Total Capability of Space Systems	Mr. Robert Trapp, Chief, Man-System Integration, Office of Advanced Research and Technology, NASA Hq.
	Major Gordon Cooper, USAF, Astronaut, Manned Spacecraft Center
Meteorological Forecast Capability Using Space Based Systems	Dr. Morris Tenper, Director, Meteorological Systems, Office of Applications, NASA Hq.
	Mr. Fred Singer, Director, National Weather Satellite Center
	Col. Jim Jones, Air Weather Service Liaison Officer.

Warm letters of thanks were received from the Scientific Director, expressing his appreciation for the outstanding contributions made by these NASA representatives at the panel meetings.

In July 1963, at the request of the Air Force, NASA officials briefed members of the FORECAST study group on NASA space programs.

The main FORECAST study effort was originally scheduled for completion in August 1963, but this target date proved to be widely optimistic. As the study developed, the report was structured as a main body, containing some highly sensitive material on such subjects as policy, strategy, force structure, intelligence, nature and performance of weapon systems, and targeting, and, as indicated earlier, the panel reports on technology as attachments.

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NASA-DOD Agreement Concerning the F12/SR71 Aircraft

During mid-1967, Defense Affairs assisted Mr. Charles W. Harper, Deputy Associate Administrator for Advanced Research and Technology (Aeronautics), in lengthy negotiations to obtain release from the Air Force of certain technical data on the F12/SR71 aircraft series needed by NASA to fulfill effectively its research role in aeronautics and its supporting role in the development, under government programs, of both military and civilian supersonic aircraft. DOD and the Air Force concurred in the desirability of making the data available to NASA, but difficulty was encountered in persuading the manufacturer to release the data, which were being held closely as proprietary information. NASA had formulated plans for studies of the F12/SR71 aircraft with the objectives of (1) helping to establish correlation between flight and propulsion system performance and predictions based upon ground facility tests and analog simulation, (2) assessing the technology advances as represented by these aircraft, and (3) identifying problem areas that had not been anticipated in early studies of other supersonic aircraft development programs.

Detailed arrangements for the collection and processing of the data needed by NASA were finally worked out and agreed upon by Col. B. W. Ellis, USAF, the F12/SR71 Systems Program Director, and Mr. J. Lloyd Jones, Jr., NASA Program Manager, Ames Research Center. These were incorporated in a "NASA-DOD Memorandum of Understanding - Collection of F-12/SR71 Aircraft Technical Data," signed by Mr. Harper for NASA and Dr. A. H. Flax for the DOD, effective October 4, 1967.

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XVII. NASA TECHNICAL SUPPORT OF THE SE ASIA WAR EFFORT

The limited warfare characteristic of our involvement in Southeast Asia, the guerrilla tactics employed by the enemy, and the nature of the terrain confronted our Armed Forces with battlefield situations they had not faced before. At the invitation of Defense Affairs, Gen. James Ferguson, Commander, AFSC, came to NASA Headquarters on November 2, 1965, with several members of his staff, to brief our top management on some of the unique technical problems arising out of the operations in Vietnam and to enlist our assistance in finding solutions to them. Mr. Webb offered the full technical support of NASA in solving the problems presented. We in Defense Affairs were assigned the responsibility of organizing and monitoring the NASA effort in this area. I designated Col. John Coulter as the cognizant officer, and all of the Headquarters officials involved felt that he did an outstanding job in coordinating NASA's efforts in this area over the following three years.

We proceeded to organize teams to make further contacts with elements of the DOD to identify more fully the specifics of the problems, and we set up procedures for applying the technological competence and capability of NASA in areas where we felt we could make a contribution. We took precautions to avoid unwarranted duplication of efforts underway in DOD laboratories.

In order to involve our Centers, we arranged an all-day meeting at Wright Field on November 22 at which both Headquarters and Center representatives were briefed in detail on the nature of the unique problems and the technological areas in which solutions were most urgently needed. Center representatives identified several areas in which they believed they could help.

We moved rapidly to organize at the management level for this undertaking. A "NASA Limited Warfare Committee" was established on December 7, 1965, with the following membership:

Mr. Earl D. Hilburn, Deputy Associate Administrator,
Chairman (Relieved by Dr. Mac C. Adams, Associate
Administrator for Advanced Research and Technology,
in June 1966)

Mr. M. J. Raffensperger, OMSF

Mr. James Spriggs, OSSA

B.Gen. B. G. Holzman, OART

Mr. C. R. Morrison, OTDA

Col. J. M. Coulter, Defense Affairs

During the week of December 5, 1965, Mr. W. J. Schimandle of JPL gave a series of briefings at NASA Headquarters as to the plans and capabilities of that Center in seeking solutions to the unique problems

associated with the limited warfare operations in SE Asia. Later in December, Air Force teams visited JPL, Ames, Goddard, Langley, MSC, and MSFC to brief Center and Laboratory personnel on the nature of the Vietnam war operations and the technical problems being encountered.

Up to this point, we had been briefed only as to the problems of the Air Force, although we learned later that there was a certain degree of problem commonality among all four Services, including the Marines. On December 7, Hilburn and I met with Lt. Gen. James Ferguson, USAF, Lt. Gen. William W. Dick, Jr., USA, and R. Adm Harold G. Bowen, Jr., USN, heads of the R&D activities in the headquarters of their respective Services, to discuss inter-Service coordination of NASA activity in support of the war in SE Asia.

On January 13, 1966, we visited Aberdeen Proving Ground to inform ourselves on what the Army was doing in this area, and on February 17 we made a similar visit to the Marine Base at Quantico. Later there were NASA visits to other DOD laboratories.

General Ferguson, General Dick, Admiral Bowen, and B. Gen. Wood B. Kyle, USMC, Deputy Chief of Staff for R&D in Marine Corps Headquarters, met with us over lunch at NASA Headquarters on February 7, 1966, to review progress to date, coordinate our activities, and map out future courses of action.

By this time, the NASA support effort was moving along with the principal effort being carried on by a group of about thirty-five research engineers (later increased to sixty-five) established for this purpose at JPL and headed by Schimandle, but with projects also underway at Ames and Langley.

A "Provost Committee" was formed in DOD, reporting to DDR&E, to coordinate the R&D activities of the individual Services related to the unique technological problems of SE Asia. It was chaired by Mr. Leonard L. Sullivan, Jr., Special Assistant to Dr. Foster, and had the R&D Deputies of the Army, Navy, Air Force, and USMC, as well as representatives from ARPA, AEC, and JCS, as members. NASA was invited to have membership on this Committee, and Colonel Coulter was appointed.

On April 12, 1966, Schimandle brought a team from JPL to Headquarters to report on their progress. He presented a list of some twenty projects which were being pursued in various degrees of priority, the most promising of which were a mortar fire locator, an improved target marker for launching from aircraft, and a coding device for tactical voice communications.

In November 1966, Dr. Foster and Dr. Seamans exchanged letters which set up guidelines, including funding arrangements, to govern the continuance of NASA's work in support of the DOD in this area. NASA's effort was running at a level of about \$4 million a year. It was agreed

that NASA would continue to fund projects in the conceptual stage, and on occasion through the breadboard and engineering model stages.

On November 10, 1966, Dr. Seamans signed a memorandum to all Heads of Program and Staff Offices and Center Directors regarding the public position of NASA with respect to its special efforts to assist in solving some of the technical problems of the war. Previous guidance had been that "the fact that we are engaged in some tasks related to the Vietnam war is not classified; the specific tasks, however, are classified." This policy was to remain in effect, but the memorandum of November 10 tightened the procedures. All inquiries would thereafter be referred to the Assistant Administrator for Public Affairs. This instruction was never rescinded. Mr. Webb's feelings about the public relations aspect of this NASA effort were that he saw no reason to hide the fact that NASA was making this contribution to national defense. I recall his saying this in a staff meeting.

On December 15, 1966, Dr. Foster gave a presentation at NASA Headquarters on the progress of the war in SE Asia and the contributions made by R&D to the effectiveness of the equipment employed by our forces. He made a plea for help from any source available in solving the problems of the war.

Colonel Coulter made a three-hour presentation at Headquarters on January 9, 1967, covering all aspects of NASA's support to DOD in the area of limited warfare. Coulter continued to be the point of contact in NASA for the NASA-DOD interface until March 1968, when this responsibility was transferred to a Special Programs Office in OART.

Schimandle came east on April 20 and on July 21, 1967, to report progress on the various projects being pursued by his group.

In August 1966, DDR&E detailed a civilian engineer, Dr. William McMillan, to be the scientific adviser attached to the staff of the Commander of U.S. Forces in Vietnam to assist him in identifying and finding quick solutions to technical problems growing out of the war. DDR&E requested NASA to detail a suitably qualified engineer to serve as an on-site assistant to Dr. McMillan, with the particular function of furthering NASA-DOD coordination. Mr. William Bergman, JPL, was detailed and served in Vietnam in this capacity from December 9, 1967, to January 15, 1969.

Eventually, some eighty-nine specific problem areas were taken under consideration by NASA scientists, engineers, and technicians.

On April 25, 1967, in my capacity as Chairman, NASA Security Classification Board, I sent out an instruction (then classified) to all NASA activities concerned with this support effort. The stated purpose of the document was "to establish uniformity in the classification of limited warfare information which requires protection in the interest of national security." Prior to this issuance, it had been necessary to respond on an individual case basis to a number of requests from Centers for guidance as to classification of limited warfare projects.

In the early months of this NASA effort, the two major and most active projects were: (1) an acoustical net to pinpoint the source of mortar fire, together with a system for transposing the incoming information rapidly into gun laying data for counter-artillery fire; and (2) an improved aircraft target marker, the principal features of which were a trail marking system to assist pilots in the early sighting of the propelling rocket, and a persistent marking signal at the impact point.

An engineering model of the mortar locator was built at JPL and given an initial field test at Ft. Sill, Oklahoma, on June 22, 1967, which was witnessed by a large group of officials from DDR&E, Air Force, Army, JPL, and NASA Headquarters, including Adams, Coulter and myself. The performance of the equipment was promising, although the tests revealed several defects needing correction. An improved set of experimental equipment was later tested under combat conditions in Vietnam, after which the responsibility for further development of the device was assumed by the Army. Generally speaking, the system performed well as a mortar locator, for which it was designed, but was not fully effective against rocket and artillery fire.

In operational tests, the aircraft target marker proved to be distinctly superior to existing models and was highly evaluated by the Air Force observers. The principal drawback was the increased cost. However, the JPL development is being used piecemeal to improve elements of current inventory equipment.

Several "quick response" developments by NASA laboratories have found combat use in SE Asia; for example, mountain top and airborne radio relays, specialized antennas, and miniaturized circuitry for backpack radio sets. The latter permitted the use of lighter batteries and reduced the total weight of the equipment by about half (approximately eighty to forty pounds).

Each combat parachute pack contains a homing radio transmitter to assist in locating a downed pilot. Occasionally, one of these transmitters in a parachute in storage will be inadvertently turned on, from one cause or another, transmitting continuously and jamming the emergency frequency. Langley developed a simple device with which an offending parachute in a storage space can be quickly located and individually identified.

Another ingenious "quickie" NASA solution to a military problem was a method of patching holes in inflated life rafts. A small balloon is put through the hole to the inside of the raft and then inflated, thus sealing the hole.

An outstanding example of product development was the work done by Ames in the field of polymer chemistry, which resulted in the development of a unique family of fire suppressant paints and foams. This work had its origin in research in ablative heat shield materials for spacecraft. Some industrial companies are currently manufacturing these materials. Their

development has generated wide interest, and their use is rapidly spreading in both military and non-military applications. They are being used in aircraft and building construction as heat insulation to prevent or at least retard the spread of fire. A special military application has been found as coating on bombs to reduce the "cook-off" effect from exposure to intense heat. Several other applications to suppress fires or reduce the spread of fires have been demonstrated.

NASA-DOD Presentations

Following is a list, probably incomplete, of the formal and comprehensive presentations given by NASA management to elements of the DOD and those received by NASA from the Military. Defense Affairs arranged and participated in nearly all of these meetings.

May 17, 1963	NASA (Seamans) briefed the JCS on the NASA space program.
July 1963	NASA briefed USAF "FORECAST" study group on NASA space programs.
Aug. 15, 1963	NASA briefed DDR&E on NASA's manned orbiting laboratory studies.
Feb. 6 & 7, 1964 (2 half days)	NASA briefed a JCS space study group on the entire NASA aerospace program.
Mar. 12, 1964	Briefing by General Schriever and assistants to AF and NASA personnel on plans for future AF developments.
Apr. 29, 1964	NASA officials exchanged briefings with AFSC regarding Aeronautics R&D programs.
Oct. 9, 1964	Air Force briefed NASA on the MOL program.
Dec. 30, 1964	NASA briefed the JCS on the NASA program.
Jan. 18, 1965	AFSC briefed NASA on latest findings, programs, and plans in the field of Composite Structures.
Mar. 3, 1965	AFSC briefed NASA on Air Force V/STOL tactical aircraft.
Mar. 5, 1965	Space Systems Division, AFSC, briefed NASA regarding survivability of space systems.
Mar. 9, 1965	NASA briefed by Continental Defense Command concerning vulnerability of space systems to nuclear detonations.
Mar. 18, 1965	NASA briefed Air Force Council on the NASA program.
Mar. 29, 1965	NASA briefed the Secretary of the Navy on NASA programs.
Apr. 19, 1965	NASA briefed AFSC on NASA's aeronautics R&D program.
June 23, 1965	NASA briefed Dr. Hall, DDR&E, on NASA support to the MOL program.
June 28, 1965	NASA-DOD meeting on MOL program.
July 19, 1965	Same.
Aug. 17, 1965	NASA briefings to Air Force officers and senior civilians on the NASA program (one-half day).
Sep. 20, 1965	NASA briefing to Army officers on the NASA program.

Oct. 18, 1965	NASA briefing to Navy officers on the NASA program.
Oct. 19, 1965	Air Force briefed NASA on MOL program.
Nov. 2, 1965	AFSC briefed NASA on problems of SE Asia war.
Dec. 21, 1965	USAF briefed NASA on Future Space Operations study.
Jan. 11, 1966	USAF briefed NASA on MOL.
Jan. 22, 1966	NASA briefed Dr. Foster and his principal assistants on the NASA Earth Sciences and Resources program.
Feb. 9, 1966	NASA briefed USAF Scientific Advisory Board on NASA Natural Resources Program.
June 30, 1966	USAF briefed NASA on MOL.
Nov. 8, 1966	USAF briefed NASA regarding AF study HINDSIGHT.
Dec. 16, 1966	USAF briefed NASA on problems of SE Asia war.
Mar. 17, 1967	AFSC briefed NASA on aeronautical weapon systems in development stages.
June 9, 1967	NASA-DOD meeting on F-12 aircraft data.
June 20, 1967	NASA briefed AFSC on the NASA aeronautics R&D program.
Oct. 19, 1967	General Stewart and Dr. Yarymovych briefed Admiral Boone on MOL progress.
Dec. 9, 1967	NASA briefed USAF in Pentagon on the NASA programs, first half-day session.
Dec. 16, 1967	Same, second half-day session.

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NASA Support to North American Air Defense Command (NORAD)

A DOD-NASA Agreement in which NASA had agreed to furnish certain tracking data to NORAD had been signed in January 1961. This agreement had been supplemented by a GSFC-NORAD implementation agreement of November 7, 1961.

At the AACB meeting on March 2, 1964, the Co-chairmen concurred in a report by a joint ad hoc sub-committee dealing with the matter of the sensitivity of the use of certain NASA tracking stations on foreign territory for tracking services associated with military projects.

On October 15, 1964, Dr. Brown forwarded to Dr. Seamans a proposed NASA-NORAD agreement prepared by NORAD to replace the GSFC-NORAD agreement of 1961. Seamans asked me to review the proposed agreement in coordination with Dr. Dryden, OTDA, and International Affairs. My report to Seamans, prepared after Headquarters coordination which included consultations with GSFC and JPL, made the following points:

- (1) The proposed new agreement goes beyond the existing NASA-DOD agreement in the matter of the priorities under which NORAD could preempt NASA stations in an emergency.
- (2) It calls for NASA to renegotiate agreements covering tracking stations in foreign territory; this would not be in accord with the sense of the ad hoc sub-committee report on this subject concurred in by Brown and Seamans.
- (3) The draft agreement would require NASA to furnish tracking data beyond its capability in some cases and costing considerably more money and effort in others.
- (4) Any replacement agreement negotiated at the NASA Headquarters levels should be with DOD, not NORAD.
- (5) The present agreement seems to be working satisfactorily; the need for a change is not evident.

Dr. Dryden and Dr. Seamans concurred in this evaluation, and Dr. Seamans signed a letter along these lines to Dr. Brown on December 10, 1964, which further suggested that NASA and DOD representatives meet to review the national requirements in space tracking. Dr. Brown concurred in this suggestion.

Representatives of GSFC, NORAD, and NASA Headquarters, including John Damon from Defense Affairs, prepared a proposed GSFC-NORAD agreement which was started through NASA Headquarters and, with minor revisions, presented to NORAD. The revised version was presented to NORAD at a meeting of representatives, including Colonel Damon, and NORAD officials at NORAD Headquarters on May 5-6, 1965. The NASA revisions were accepted and the agreement was subsequently signed, effective June 15, 1965.

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DOD Support in Lunar Mapping

Being aware of DOD's extensive competence and background of experience in the development, procurement, and operational use of aerial mapping and survey equipment, NASA sought the assistance of the DOD in meeting its requirements in the similar field of lunar mapping and survey operations as part of Project Apollo.

A "DOD/NASA Agreement on the NASA Manned Lunar Mapping and Survey Program" was formalized on April 20, 1964. It stated that the Air Force, as the responsible DOD agency, would provide assistance to NASA by developing and providing, on a reimbursable basis, manned lunar mapping and survey flight equipment designed to meet NASA's needs. Under the agreed arrangement, NASA would submit to the Air Force performance goals and delivery requirements for the lunar mapping and survey subsystems. The Air Force would make the contractor selection in coordination with the responsible NASA personnel and would develop the equipment to meet the NASA specification. General management of the effort would be performed by a small joint NASA-Air Force team which would, among other things, define the detailed division of responsibilities for such matters as reliability, quality control, systems engineering, cost accountability, operations, photographic processing, etc. The arrangement worked out very well in practice.

In implementing this arrangement, however, a need developed within NASA for a small organization of persons having the experience and capability to carry on a continuing review and evaluation of the nature and extent of mapping requirements growing out of NASA programs, and of the availability of technical resources in other agencies for meeting these needs. Col. A. T. Strickland, on detail to NASA from the Army, was the only person available to discharge these responsibilities at that time.

On May 24, 1965, I wrote to Lt. Gen. W. K. Wilson, Jr., USA, Chief of Engineers, U.S. Army, asking whether the Corps of Engineers could assist us in meeting NASA's staff requirements in this area, a matter which previously had been discussed by Colonel Strickland with senior members of General Wilson's staff. As a result of this request, Mr. William H. Shirey, who had a strong background of experience in mapping and survey operations both in the Army and Air Force, was lent to NASA by the Corps of Engineers as a civilian detailee in the summer of 1965. (He is still serving with NASA in that capacity.)

After a number of interagency conferences in which Defense Affairs participated, it was determined that the Defense Intelligence Agency (DIA) was the government agency best equipped to support NASA in meeting its requirements for technical assistance, production, and management services in the general field of lunar and other extraterrestrial mapping, charting, and geodesy. Accordingly, negotiations were carried on with the DOD which led

to an "Agreement Between the Department of Defense and the National Aeronautics and Space Administration Concerning Extra-terrestrial Mapping, Charting, and Geodetic Support," signed into effect on March 8, 1966.

The Agreement provided that the DIA would be the coordinating agency within the DOD to provide, on a reimbursable basis, the support in this area requested by NASA. To permit the necessary integration by DIA of the programming and budgeting actions by the several components of DOD which would provide the support involved, NASA would, at least fifteen months in advance of the start of a fiscal year, furnish reasonably firm data on NASA's requirements and priorities for that fiscal year. DIA would, in turn, advise NASA of the DOD proposed organization, time schedules, costs, and results to be expected in meeting the NASA requirements. The necessary support to meet NASA's stated requirements would be developed by DIA in coordination with appropriate NASA personnel. DIA would exercise general management of the supporting DOD development and production effort through a small planning team which would meet with NASA representatives for coordinated planning as appropriate.

As a result of this agreement, all of the lunar grids and topographic maps needed for the selection of lunar landing sites, and all of the processing of lunar geodetic data required in the Apollo operations around the moon as well as in the scientific study of the moon, were done for NASA by the DOD. The arrangement was highly beneficial to both parties. It was efficient and economical in that NASA benefited from the skills and craftsmanship of the best experts in the field without duplicating the expensive equipment available in the DOD and without the necessity of assembling a qualified staff of its own to provide the needed products. Through active involvement in the space program, those elements of the DOD engaged in the field of mapping, survey, and the processing of geodetic data were enabled to expand their sphere of operations and experience beyond the Earth to other bodies in the solar system.

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